Medical Student Research

Anaemia in pregnant women in eastern Caprivi, Namibia

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Objective. To describe the prevalence, character and possible aetiology of anaemia in the study region.

Design. A cross-sectional study involving a lifestyle and dietary questionnaire, a clinical examination and an analysis of blood and stool samples.

Setting. Katima Mulilo antenatal clinic, East Caprivi, Namibia.

Subjects. 171 pregnant women attending the clinic in September 1995.

Main outcome measures. Effects on haemoglobin concentration of age, trimester, parity, residential area, sociodemographic factors, malaria, parasites, geophagy, diet, cooking pot used, vitamin and mineral supplementation and malaria prophylaxis.

Results. 41.5% of the women were found to be anaemic (haemoglobin < 11 g/dl) and there was a significant risk of their being iron-deficient ($P = 0.01$). Three maternal characteristics were found to have a significant effect on a woman's risk of anaemia: urban residence ($P < 0.05$), geophagy ($P < 0.01$) and the taking of prophylactic chloroquine ($P < 0.05$).

Conclusion. Mild anaemia affects a large proportion of the pregnant women in East Caprivi; severe anaemia (< 7 g/dl) is not common. The picture is predominantly one of iron deficiency, possibly complicated by concomitant folate deficiency. There is no single easily identifiable cause of this anaemia; it appears to have a multifactorial aetiology. Further studies on the effect of the current malaria prophylaxis programme are warranted.

S Afr Med J 1997; **87:** 1544-1547.

The World Health Organisation recommends that haemoglobin levels should not drop below 11 g/dl in pregnancy.[1] By this criterion, half of all pregnant women in Africa are anaemic. Iron deficiency associated with depleted stores and insufficient intake accounts for over 90% of anaemia in pregnancy.[2] The significance of this anaemia is controversial,[3-5] but there is no doubt that low haemoglobin concentrations and iron deficiency can be linked to maternal and fetal morbidity and mortality.[6-12]

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In recognition of this and in line with WHO targets, the Namibian Ministry of Health and Social Services (MOHSS) has adopted a primary health care (PHC) strategy for achieving health for all Namibians by the millennium. One of the major tasks of the PHC team is to initiate the Maternal and Child Health/Family Planning Programme which, among other things, seeks to identify high-risk groups among pregnant women, provide appropriate intervention and decrease morbidity and mortality associated with pregnancy.[13] In East Caprivi, antenatal care is provided at 10 of the PHC clinics in the region but women are encouraged to attend the initial booking clinic in the main town, Katima Mulilo. It is not known what percentage of women in this area take advantage of the antenatal care on offer. The WHO estimates that 35% of pregnant women in southern Africa are anaemic at any one time[14] but, to date, no statistics have been available for Caprivi, until very recently a politically unstable region. I therefore conducted a cross-sectional study to: (*i*) describe the prevalence and type of anaemia among pregnant women in East Caprivi; and (*ii*) assess the role of possible aetiological factors in the hope that the information gathered could be of use to the MOHSS for further studies and future decisions on clinical policy.

Subjects and methods

One hundred and eighty-five women attending the Katima Mulilo antenatal clinic during September 1995 were asked to take part in the study. The nature of the project was explained to the women by a local nurse and they gave their verbal consent. Fourteen records are not complete and these have been excluded from the study. Results of the remaining 171 pregnant women are therefore presented.

A questionnaire was drawn up incorporating questions about past medical history, current symptoms of anaemia, lifestyle and diet. The food frequency part of the questionnaire was the result of much discussion with local people and use of the CTA/ECSA (Centre Téchnique et Agriculturel/East, Central and Southern Africa) food composition tables for East Africa[15] as a guideline for the groupings of foodstuffs. The questionnaire was piloted at the clinic, and 20 women were evaluated.

The sample size was estimated on the basis of the number of subjects needed to detect, with $\alpha = 0.05$ and $1\text{-}\beta = 0.8$, any risk factor for anaemia associated with a crude odds ratio (OR) of 3.0 or more. The calculation was done by assuming a risk factor prevalence of between 25% and 75%, and a disease prevalence in the unexposed of 30%. The minimum total sample size estimated with the sample size calculator of the EPI INFO programme was 124 for risk factors with a prevalence of 50%, 160 for risk factors with a prevalence of 25% and 165 for risk factors with a prevalence of 75%. Therefore a minimum of 165 subjects was required for the study.

The questionnaire was administered to each woman either in English or the local language, Losi; where necessary the help of an interpreter was enrolled to clarify complex issues. Results of a physical examination were recorded and stool and venous blood samples (EDTA tubes) were taken. The stool samples were checked for hookworm ova in the Katima Mulilo Hospital laboratory and a full blood count

carried out on one of each woman's blood samples with a Coulter counter model CBC5. The second sample was sent to Windhoek State Hospital laboratory for analysis of serum iron, total iron-binding capacity (TIBC) and percentage saturation with Beckman Synchron CX systems. Because of technical problems with the Katima Mulilo Coulter counter, some of the full blood count analyses were also carried out in Windhoek.

The data were analysed with SPSS for Windows. The results of univariate and multivariate analysis are presented with 95% confidence intervals (CIs). Logistic regression was used for the multivariate analysis.

Results

The mean haemoglobin concentration was 11.2 g/dl (SD 1.52) with a range of 7.1 to 18.3 g/dl. The median was also 11.2 g/dl within interquartile ranges 25% to 75% of 10.3 to 12.2. Of the women 41.5% were found to have a haemoglobin concentration lower than 11 g/dl. None of the women was severely anaemic as defined by the WHO (Hb < 7 g/dl). The median percentage saturation of TIBC was 18.0% within interquartile ranges 25% to 75% of 10% to 28%. Of the women 42.1% were found to have established iron deficiency, with a percentage saturation of TIBC less than 16%, and 82.5% of these had percentage saturations of less than the normal range of 30 - 34%. The anaemic women were significantly more likely to be iron-deficient ($P = 0.01$) than those with haemoglobin concentrations of 11 g/dl or above.

Other haematological parameters were unremarkable. The mean value of the mean corpuscular volume of the anaemic women remained within normal limits, suggesting the possibility of a concomitant deficiency of folate. Serum folate levels were not measured.

The demography of the anaemia found in this region is shown in Table I. The adjusted ORs show that neither age, stage of pregnancy, parity nor socio-economic group had any significant effect on a woman's risk of anaemia; however, the domiciliary area was a significant variable. Women living in the main town of Katima Mulilo have a greater risk of being anaemic ($P = 0.03$) than those living in the outlying villages. Table II shows the influence of various other possible contributory factors, after the demographic factors in Table I are adjusted for. Geophagy (ingestion of earth) is associated with an increased risk of anaemia ($P = 0.001$), as is the taking of prophylactic chloroquine ($P = 0.02$). Stratification of the mineral and vitamin supplement data showed a strong relationship with regard to whether the three pills on offer were being taken; women taking iron and folate were 16 times more likely also to be taking chloroquine (CI 7.21 - 37.46) and those taking multivitamins were 33 times more likely also to be taking chloroquine (CI 13.97 - 77.18). Table III shows a multivariate analysis of the effect of taking the three pills on offer, adjusting for each other and for the demographic factors in Table I. The addition of geophagy to the model changed the effect of chloroquine very little (OR 0.35; CI 0.13 - 0.96; $P = 0.04$).

Discussion

It was originally suggested that this study should concentrate on a possible link between haemoglobin concentrations and dietary intake, although very few studies have managed to corroborate the view that iron deficiency anaemia results from a poorer intake of iron-containing foods. The food frequency part of the questionnaire used in this study was extensively analysed, taking into account the inhibitory effect of the women's calcium intake on iron

Table I. Demography of anaemia in eastern Caprivi

Factors	No. ($N = 171$)	Hb < 11 g/dl (No.) ($N = 71$)	Univariate analysis OR	Univariate analysis CI	Multivariate analysis Adjusted* OR	Multivariate analysis 95% CI
Age category (yrs)						
< 20	38	39.5% (15)	1		1	
20 - 30	101	44.6% (45)	1.23	0.58 - 2.63	1.16	0.43 - 3.12
> 30	32	34.4% (11)	0.80	0.30 - 2.13	0.76	0.19 - 3.03
Trimester						
1 or 2	67	40.3% (27)	1		1	
3	104	42.3% (44)	1.08	0.58 - 2.03	1.14	0.60 - 6.08
Parity						
0	68	39.7% (27)	1		1	
1 - 3	78	44.9% (35)	1.24	0.64 - 2.39	1.24	0.52 - 2.96
≥ 4	25	36.0% (9)	0.85	0.33 - 2.21	1.19	0.32 - 4.34
Area						
Outlying villages	89	33.7% (30)	1		1	
Katima	82	50.0% (41)	1.96	1.06 - 3.65	2.13	1.10 - 4.17
Sociodemographic category						
High	36	38.9% (14)	1		1	
Medium	70	47.1% (33)	1.40	0.62 - 3.18	1.70	0.72 - 4.02
Low	65	36.9% (24)	0.92	0.40 - 2.13	1.31	0.52 - 3.30

* Adjusted for all demographic factors listed.

Table II. Factors contributing to anaemia

Factors	No. (*N* = 171)	Hb < 11 g/dl (No.) (*N* = 71)	Univariate analysis OR	Univariate analysis CI	Multivariate analysis Adjusted* OR	Multivariate analysis 95% CI
Malaria						
Never	19	31.6% (6)	1		1	
In 1995	65	47.7% (31)	1.97	0.67 - 5.83	2.13	0.68 - 6.69
< 1995	87	39.1% (34)	1.18	0.69 - 2.00	1.34	0.45 - 4.04
Parasites†						
None	91	46.2% (42)	1		1	
Hookworm and others	13	46.2% (6)	1.00	0.31 - 3.21	0.83	0.24 - 2.84
Ablution facility						
Latrine or flush toilet	63	36.5% (23)	1		1	
Bush	108	44.4% (48)	1.39	0.74 - 2.63	1.75	0.81 - 3.45
Geophagy						
No	95	30.5% (29)	1		1	
Yes	76	55.3% (42)	2.81	1.50 - 5.27	2.99	1.52 - 5.86
Dietary iron intake						
High	73	43.8% (32)	1		1	
Low	98	39.8% (39)	0.85	0.46 - 1.57	0.93	0.49 1.82
Cooking pot						
Iron	32	46.9% (15)	1		1	
Aluminium	139	40.3% (56)	0.76	0.35 - 1.66	0.41	0.16 - 1.05
Iron/folate supplements						
Yes	64	50.0% (32)	1		1	
No	107	36.4% (39)	0.57	0.31 - 1.08	0.52	0.26 - 1.03
Chloroquine						
Yes	84	52.4% (44)	1		1	
No	87	31.0% (27)	0.41	0.22 - 0.76	0.36	0.18 - 0.71
Multivitamins						
Yes	90	47.8% (43)	1		1	
No	81	34.6% (28)	0.58	0.31 - 1.07	0.58	0.30 - 1.14

* Adjusted for all demographic factors listed in Table I.
† Stool analysis results are only available for 104 women.

Table III. Mineral and vitamin supplementation and anaemia

Factors	No. (*N* = 171)	Hb < 11 g/dl (No.) (*N* = 71)	Univariate analysis OR	Univariate analysis CI	Multivariate analysis Adjusted* OR	Multivariate analysis 95% CI
Iron/folate supplements						
Yes	64	50.0% (32)	1		1	
No	107	36.4% (39)	0.57	0.31 - 1.08	0.79	0.34 - 1.89
Chloroquine						
Yes	84	52.4% (44)	1		1	
No	87	31.0% (27)	0.41	0.22 - 0.76	0.32	0.12 - 0.85
Multivitamins						
Yes	90	47.8% (43)	1		1	
No	81	34.6% (28)	0.58	0.31 - 1.07	1.41	0.53 - 3.70

* Adjusted for all demographic factors listed in Table I and for iron/folate supplements, chloroquine and multivitamins.

absorption[16] and the enhancing effect of vitamins C[17] and A[18,19] in their diet; no significant effect was found, however. People in Caprivi are known to have multiple dietary deficiencies,[20,21] yet they also have high intakes of contaminant iron from their cooking pots[22] and from the earth[23,24] they ingest. Seventy-six (44.4%) of the women in this study admitted to eating earth and 51% of these said that they ate it every day of the week. It is taken primarily from the tops of termite mounds, a source known to be rich in organic material,[25] and analysis of a sample from a popular anthill in central Katima Mulilo via a method devised by Hallberg and Bjorn-Rasmussen[26] has shown that the iron

in it has a high percentage exchangeability and is therefore a potentially good source (S Fairweather-Tait, T E Fox — unpublished observation). Geophagists in this study have an increased risk of being anaemic, yet 44.7% of them had haemoglobin concentrations of 11 g/dl or above. Geophagy may therefore be a risk marker for anaemia, but it is not likely to be an aetiological factor in the disease and, on the contrary, is probably beneficial. Hookworm infestation is known to be an important cause of iron deficiency anaemia and is endemic in this region.[27] Soil ingestion is unlikely to increase the likelihood of becoming infested since these helminth larvae are only found within a 10 cm radius of infected human faeces.[28] As it is not the norm for people to climb to the top of a termite mound to defecate I would suggest that the risk of ingesting hookworm larvae in geophagy is necessarily small. The presence of parasites in the stool samples in this study was not associated with an increased risk of anaemia. The number of positive stool samples was small, which may have been a fault of the microscopy methods; ova can be missed if the worm load is light, as is often the case in infected people in endemic areas.

Malaria is one of the five main causes of anaemia in the black population as a whole[29] and is endemic in eastern Caprivi.[27] In this study a history of malaria was not found to have a statistically significant effect on a woman's risk for anaemia but thick films and inspection of the placenta after delivery would more definitively assess the role played by *Plasmodium falciparum* in the aetiology of anaemia.

The risk of anaemia in women living in the main town is significantly greater than in those living in the more rural areas, yet there is no significant difference in the risk of iron deficiency (OR 1.05, CI 0.57 - 1.92, $P = 0.6$) in each of the two residential groups, which suggests that the anaemia found in Katima is not of the iron deficiency type. With regard to the other two significant variables (chloroquine taking and geophagy), the risk of iron deficiency mirrors that of anaemia.

This study suggests that women taking chloroquine are three times as likely to be anaemic as those not taking it. Women taking iron and folate supplements and multivitamins are very much more likely also to be taking chloroquine, hence the discrepancies between the multivariate analyses in Tables II and III in respect of these two supplements, particularly multivitamins. This means that mineral supplementation seems to offer little protection against anaemia. It may be that anaemic women feel different and are therefore more likely to take all their tablets. In taking chloroquine, they are possibly worsening their anaemia which is not being countered by the other supplements. However, very few of the women had haemoglobin concentrations sufficiently low to be symptomatic. An alternative explanation is that protection from malaria in the form of chemoprophylaxis leads to an increase in birth weight[30] and that a larger baby puts an added stress on maternal iron stores. Anaemia is a recognised side-effect of chloroquine, but supposedly not in prophylactic doses.[31]

Simply to ask the women which pills they were taking is not a reliable method of assessing their true intake, and further studies on the supplementation programme are warranted before clinical policy changes based on these preliminary findings are adopted.

I am grateful to the Namibian Ministry of Health and Social Services for permission to publish this study, to Professor David Mant and Dr Paul Little for guidance at every stage and to Alistair Shiell for invaluable statistical advice.

The study was supported in part by elective awards from the Glaxo Medical Fellowship, the British Medical and Dental Students Trust, the British Nutrition Foundation, the Royal College of General Practitioners, the Commonwealth Foundation, the Wellcome Trust, the Medical Research Council and Lederle Laboratories.

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Accepted 14 Apr 1997.